ONTARIO MINISTRY OF ENVIRONMENT
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ONTARIO WATER
RESOURCES COMMISSION

ANNUAL REPORT 1964

PRESTON

water pollution control plant

TD
367
.A56
P748
1964
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DIVISION OF PLANT OPERATIONS
Ontario Water Resources Commission

TD
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P748
1964

Preston : water pollution control plant.

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ONTARIO WATER RESOURCES COMMISSION

OFFICE OF THE GENERAL MANAGER

Members of the Preston Local Advisory Committee,
Town of Preston.

Gentlemen:

We are pleased to provide you with the 1964 Operating Report for the Preston Water Pollution Control Plant, OWRC Project No. 59-S-46.

By continuing the mutual cooperation which has existed in the past, we can look forward to greater progress in the field of water pollution control.

Yours very truly,

D. S. Caverly,
General Manager

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General Manager,
Ontario Water Resources Commission.

Dear Sir:

It is with pleasure that I present to you the Annual Report of the operation of the Preston Water Pollution Control Plant, OWRC Project No. 59-S-46 for 1964.

This report presents design data, outlines operating problems encountered and summarizes in tables, charts and graphs all significant flow and cost data.

Yours very truly,

B. C. Palmer, P. Eng.,
Director,
Division of Plant Operations.

FOREWORD

This report describes the operation of this project for the year 1964. It includes a detailed description of the project, summary of operation, graphs and charts showing quality and quantity information, and project cost data.

This information will be of value to the municipality in assessing the adequacy of the works in meeting existing requirements and in projecting its capability to meet future expected demands. The cost information will be of particular interest to those concerned with developing and maintaining revenue structures.

The preparation of this report has been a cooperative effort of several groups within the Division of Plant Operations. These include the Statistical Section, Brochures Officer and the Regional Supervisor. However, the primary responsibility for the content has been with the Regional Operations Engineer. He will be pleased to discuss all aspects of this report with the municipality.

B. C. Palmer, P. Eng.,
Director,
Division of Plant Operations.

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PRESTON

water pollution control plant

operated for

THE TOWN OF PRESTON

by the

ONTARIO WATER RESOURCES COMMISSION

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DIVISION OF PLANT OPERATIONS

DIRECTOR: B. C. Palmer

Assistant Director: C. W. Perry
Regional Supervisor: D. A. McTavish
Operations Engineer: B. G. Porter

801 Bay Street Toronto 5

'64 REVIEW

The following report gives in detail significant data on the operation of the various treatment units of the Preston Water Pollution Control Plant.

The average daily flow of about 0.78 million gallons is well below the design flow of 1.8 million gallons. There has not been a trend to an increase in the average yearly flows as expected, however, with the growth of Preston, the flows will increase in the future. It should be noted that the graph of average daily flows for 1963 and 1964, shows an increase during the later part of 1964. During the summer and fall, most of the flow results from sewage rather than infiltration. The high flows in the spring of each year are due to infiltration of water from the spring thaw.

The average BOD for the last nine months of the year in the final effluent was acceptable to the OWRC, however, the values early in the year were high. This trend is normal during the cold months of the year and also during peak flow periods.

The BOD and suspended solids of the influent were much higher in concentration than expected in the design of the plant, however, the sewage is of such a quality that it is easily treated and particularly applicable to vacuum filtration as indicated by the low consumption of chemicals.

Operating costs for 1964 were almost the same as for 1963 and were low due to good filter operation and low maintenance and repair costs. It can be expected that all costs will increase as the plant loading increases and equipment begins to wear out.

The plant staff has maintained a clean, attractive and efficient plant for the Town of Preston, special attention is given to good public relations and every year many visitors tour the facilities.

GLOSSARY

BOD	biochemical oxygen demand (a measure of organic content)
cfm	cubic feet per minute
comminution	shredding of solids into small fragments
DWF	dry weather flow
effluent	outflow
flocculation	bringing very small particles together to form a larger mass (the floc) before settling
fps	feet per second
gpcd	gallons per capita per day
gpm	gallons per minute
grit	sand, dust, stones, cinders and other heavy inorganic material
influent	inflow
lin. ft.	lineal feet
mgd	million gallons per day
mlss	mixed liquor suspended solids
ppm	parts per million
ss	suspended solids
TDH	total dynamic head (usually refers to pressure on a pump when it is in operation)

HISTORY
1960 - 1964

INCEPTION

The Town of Preston and the Ontario Water Resources Commission initiated plans for the construction of a modern sewage treatment plant.

The firm of Proctor and Redfern, Toronto, Ontario, Consulting Engineers, was engaged to prepare plans and specifications for the project.

APPROVAL

In November 1961, the Town signed an agreement with the Ontario Water Resources Commission to finance, construct and operate the project.

CONSTRUCTION

Louis Donolo Construction Limited began construction in December of 1961. The Division of Plant Operations commenced operation of the project in February 1963.

TOTAL COST

Total capital cost of the project was $620,000.00.

Project Staff

E. SIMPSON
CHIEF OPERATOR

Operators

J. Geens L. Sage
J. Dillow

COMMENTS

The normal complement of staff consists of one chief operator and two operators. During the week, Monday to Friday, the plant was staffed eight hours per day. Staff rotation provides four hours coverage per day on Saturday and Sunday.

During the year, Mr. Sage left the commission and was replaced by Mr. J. Dillow.

Mr. Simpson received his Certificate of Qualification as a Sewage Works Operator in 1963. The rest of the staff will also be undertaking the same courses during the next two years.

Description of Project

INFLUENT WORKS

The flow enters the plant through two 24 inch diameter sewers which empty into a 36 inch diameter sewer. After passing through a coarse bar screen the flow passes to the grit removal unit (detritor). Here the flow is maintained at one foot per second so that the heavy grit will settle out and the lighter solids will remain in the sewage. The grit is collected from the detritor by a mechanical rake and hauled out of the plant with the filtered sludge. The flow continues through a barminutor which cuts the large material. This may be by-passed through a manually cleaned bar screen. Both units, are 36 inches in width.

PRIMARY CLARIFIERS

The flow then enters two circular primary clarifiers. Here the sewage is stored for 3. 3 hours, at design flow, and the heavy solids are allowed to settle to the bottom. Each clarifier is equipped with circular sludge scrapers and skimmers, which direct sludge and scum into hoppers. The sludge is then pumped to the sludge holding tank or the coil filter, while the primary effluent flows to the low lift wet well, where it is pumped to

the aeration section.

AERATION SECTION

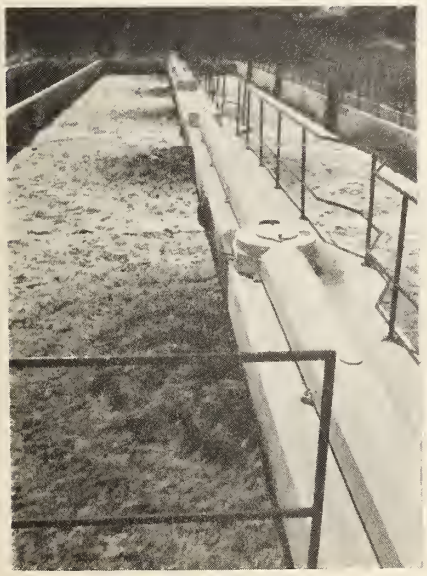
In the aeration section, primary effluent is mixed with the return activated sludge and aerated by means of mechanical aerating devices, which thoroughly mix the tank contents. There are two single pass aeration tanks which retain the flow for 9.2 hours at design flow.

FINAL CLARIFIERS

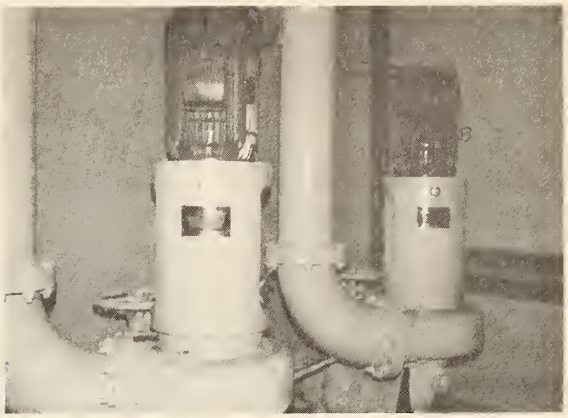
The flow then passes to the final settling tanks. Here the mixed liquor separates into rapid settling sludge and clear effluent. The effluent is directed to the chlorine contact chamber and the sludge is pumped back to the plant, either to the aeration section as return activated sludge, where it is again used in the process, or to the primary clarifier where it settles with the raw sludge. The retention time in the final clarifier is 3.0 hours at design flow.

CHLORINE CONTACT CHAMBER

The effluent is retained in the chlorine contact chamber for 15 minutes to ensure destruction of pathogenic bacteria before being discharged to the Grand River.



AERATION TANK



SEWAGE LIFT PUMPS

CONVEYOR BELT FOR SLUDGE HAULING

VACUUM FILTER

The sludge that is removed from the sewage is pumped either directly to the vacuum filter or to the sludge holding tank and then to the filter. The filter media are coiled stainless steel springs. The drum is placed under vacuum and moisture is withdrawn from the sludge. Appurtenances included with the filter are a vacuum pump, filtrate receivers, lime and ferric chloride tank, mixing tanks and sludge pump.

In order to ensure rapid efficient filtering, the sludge is generally mixed with lime and ferric chloride. This coagulates the sludge and the filtering is greatly improved. The filtrate (liquid portion) is returned to the process.

PROJECT COSTS

STAGE I

LONG TERM DEBT: (Total Capital Cost)	$147,617.75

The total cost to the municipality during 1964 was as follows:

Net Operating	$ -
Debt Retirement	2,979.00
Reserve	1,086.00
Interest Charged	8,305.02
TOTAL	$ 12,370.02

RESERVE ACCOUNT

Balance at January 1, 1964	$ 3,520.19
Deposited by municipality	1,086.00
Interest Earned	216.63
	$ 4,822.82
Less Expenditures	-
Balance at December 1, 1964	$ 4,822.82

DEBT OUTSTANDING:	$134,492.24

STAGE II

LONG TERM DEBT: (Total Capital Cost)	$219,092.56

The total cost to the municipality during 1964 was as follows:

Net Operating	$ 30,646.67
Debt Retirement	4,281.00
Reserve	4,673.00
Interest Charged	10,404.36
TOTAL	$ 50,005.03

RESERVE ACCOUNT

Balance at January 1, 1964	$ 3,931.33
Depsoited by municipality	4,673.00
Interest Earned	314.52
	$ 8,918.85
Less Expenditures	-
Balance at December 1, 1964	$ 8,819.85

DEBT OUTSTANDING:	$210,831.34

MONTHLY COSTS

MONTH	TOTAL EXPENDITURE	PAYROLL	CASUAL PAYROLL	FUEL	POWER	CHEMICAL	GENERAL SUPPLIES	EQUIPMENT	REPAIRS & MAINTENANCE	SUNDRY	WATER
JAN	3554.67	983.70		147.75	401.66	1428.92	46.82	111,91		25.5	408.41
FEB	2010.09	983.70			402.21	(450.00)	258.64	426.56	174.17	214.81	
MARCH	1871.99	1073.70		135.90	402.00	(450.00)	78.41	26.84	48.56	181.57	375.01
APRIL	955.28	983.70		131.36	422.84	(900.00)	43.27	11.33	123.52	139.36	
MAY	3027.42	1475.55	129.72		368.35	(13.23)	24.87		340.11	297.46	404.59
JUNE	5826.69	1167.05	10.78		354,65	3709.40	346.59		14.94	223.28	
JULY	1770.70	973.52			355.41	(450.00)	35,73	151.80	55.78	296.67	378.79
AUG	1951.66	1217.30			365.00		24.81		3.24	341.31	
SEPT	1723.02	1121.28			345.06	(450.00)	15.92		167.44	153.98	369.34
OCT	3736.20	890.80	207.20		360.21	696.08	122.92	87.83		1371.16	
NOV	2284.77	1093.96	126.64		345.06		51.81		91.18	203.00	373.12
DEC	1937.18	1653.33		118.80	795.38	(1501.10)	59.83	26.46	242.50	184.17	357.81
TOTAL	30646,67	13617.59	474.34	533.71	4917.83	1620.07	1109.62	842.73	1261.44	3605.27	2667.07

BRACKETS INDICATE CREDIT

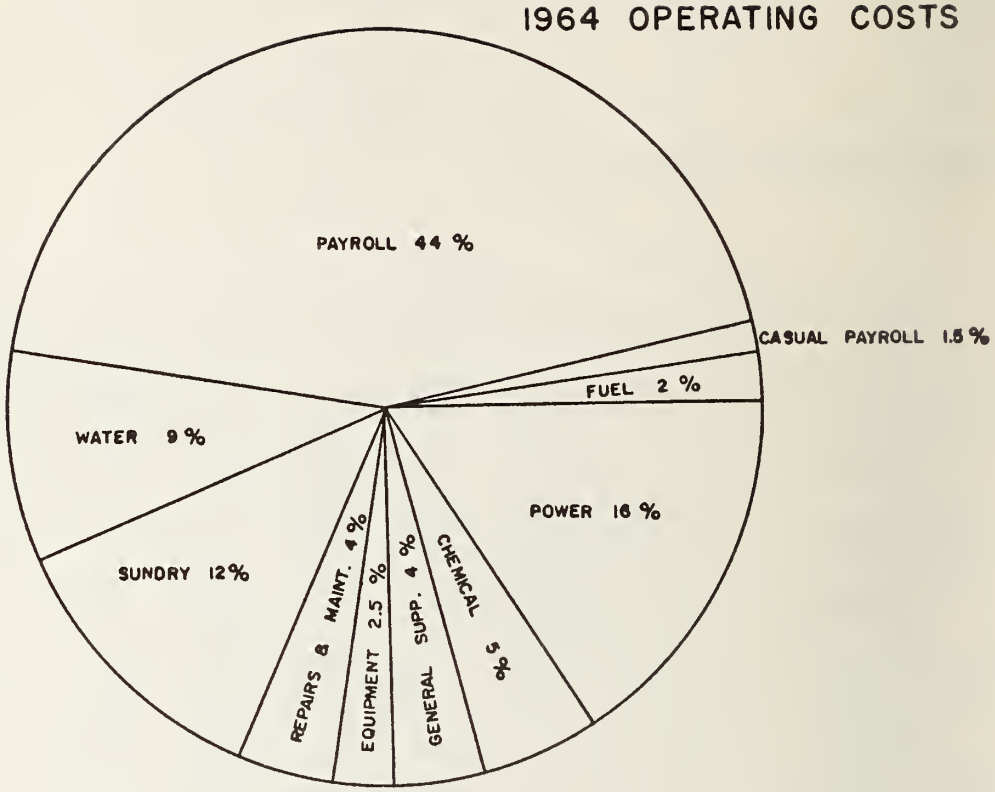
YEARLY COSTS

YEAR	M.G. TREATED	TOTAL COST	COST PER FAMILY PER YEAR	COST PER MILLION GALLONS	COST PER L.B. OF BOD REMOVED
1963	284.127	$30,651.00	$9.91	$108.00	2 1/2 CENTS
1964	284.326	$30,649.67	$9.67	$107.80	2 1/2 CENTS

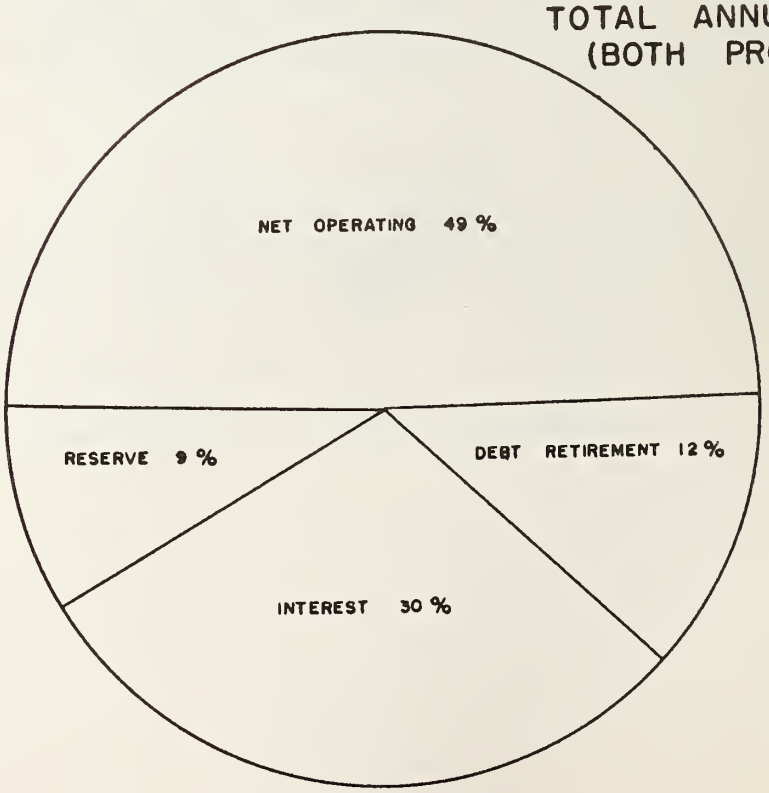
VACUUM FILTER COSTS

MONTH	COST PER MONTH					TOTAL	COST PER TON DRY WEIGHT					TOTAL
	$FeCl_3$	LIME	LABOUR	ELEC	MAINT		$FeCl_3$	LIME	LABOUR	ELEC	MAINT	
JANUARY	27.36	19.25	166.66	52.76	41.66	307.69	0.52	0.36	3.16	1.00	0.79	5.83
FEBRUARY	-	-	166.66	52.66	41.66	260.98	-	-	3.16	1.00	0.79	4.96
MARCH	43.03	-	166.66	53.68	41.66	305.03	0.80	-	3.10	1.00	0.78	5.68
APRIL	133.90	50.22	166.66	49.28	41.66	441.72	2.71	1.02	3.38	1.00	0.85	8.96
MAY	18.98	-	166.66	45.68	41.66	272.98	0.42	-	3.65	1.00	0.91	5.98
JUNE	15.28	0.18	166.66	32.40	41.66	256.18	0.47	0.01	5.14	1.00	1.29	7.91
JULY	153.20	71.75	166.66	50.30	41.66	483.57	3.05	1.43	3.31	1.00	0.83	9.61
AUGUST	27.04	-	166.66	31.73	41.66	267.09	0.85	-	5.25	1.00	1.31	8.42
SEPTEMBER	35.49	-	166.66	30.92	41.66	274.73	1.15	-	5.39	1.00	1.35	8.89
OCTOBER	47.12	7.88	166.66	26.04	41.66	289.36	1.81	0.30	6.40	1.00	1.60	11.11
NOVEMBER	155.61	71.75	166.66	49.97	41.66	485.65	3.11	1.44	3.34	1.00	0.83	9.72
DECEMBER	19.04	-	166.74	53.30	41.74	280.82	0.36	-	3.13	1.00	0.78	5.27
TOTAL	676.05	221.03	2000.00	528.72	500.00	3925.80	15.25	4.56	48.41	12.00	12.11	92.34
AVERAGE PER MONTH	56.34	18.42	166.66	44.06	41.66	327.15	1.28	0.42	3.78	1.00	0.95	7.42

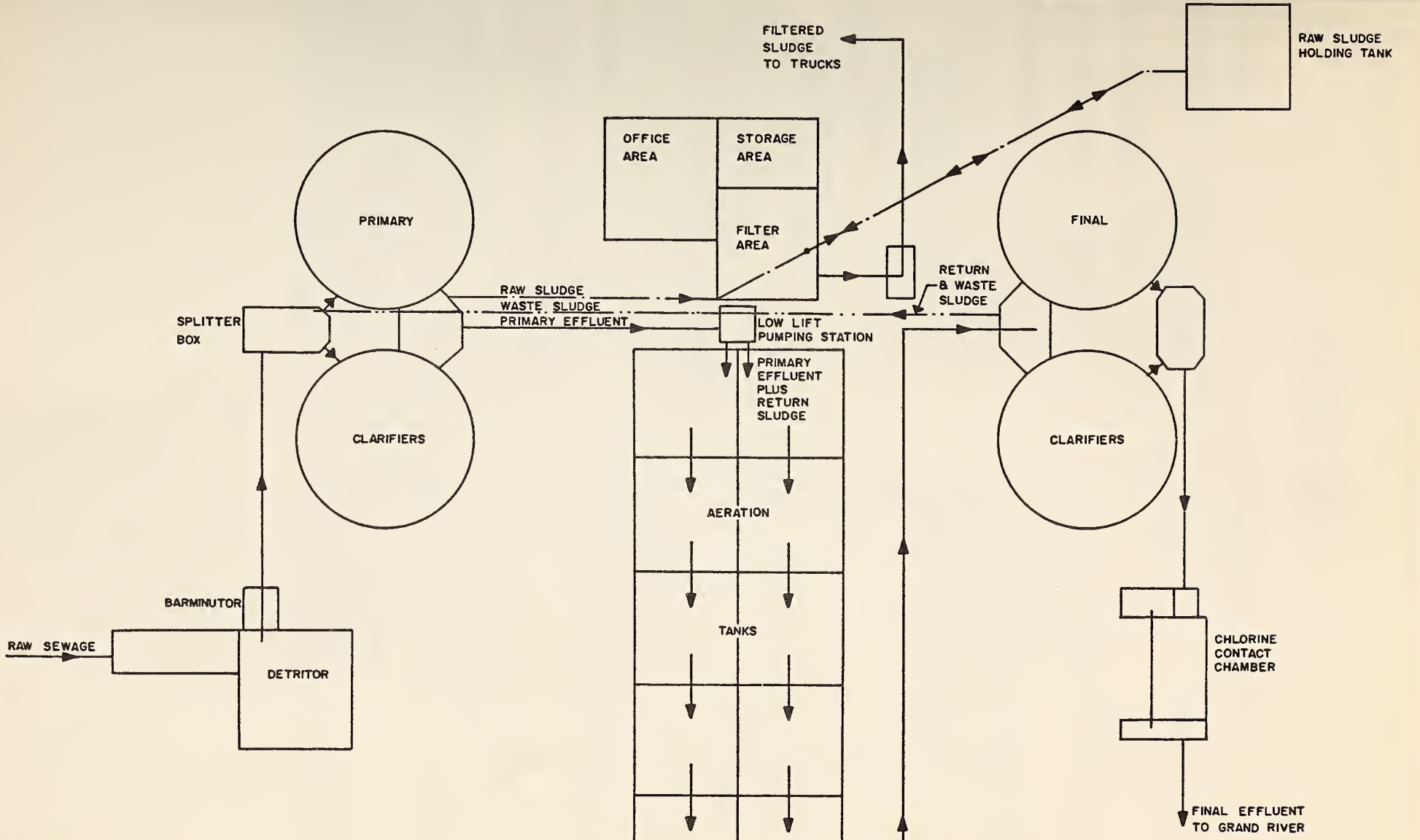
1964 OPERATING COSTS



TOTAL ANNUAL COST (BOTH PROJECTS)



Technical Section



PRESTON W.P.C.P.

SCHEMATIC OUTLINE OF PLANT SHOWING SEWAGE FLOW

Design–Data

GENERAL

Type of Plant - Activated sludge Mechanical Aeration.

Design Population - 15,000

Design Plant Flow - 1.8 MGD

Per Capita Flow - 120 GPD

Five Day BOD

Raw Sewage - 300 ppm
Removal - 95%

Suspended Solids -

Raw Sewage - 350 ppm
Removal - 90%

PRIMARY TREATMENT

Dorr-Oliver Long detritor, mechanical grit collector, rake washer and organic return.

Screening

Barminutor Model "C"
Manufactured by Chicago Pump Company Limited.

PRIMARY CLARIFIERS

2 concrete 50 ft. diameter - 10 ft. deep
Volume - 246,000 gallons
Retention time - 3.3 hours
Surface settling - 460 gal/ft./day
Weir overflow - 5,730 gal/ft./day
Mechanism by Dorr-Oliver Long

SEWAGE LIFT PUMPS

2 - 1800 gpm Worthington mixed flow pumps.

SECONDARY TREATMENT

Aeration Section

2 concrete tanks, each with 5 Ames-Crosta Mills aerators.
Dimensions - 150 ft. x 30 ft. x 13 ft.
Volume - 731,000 gallons
Retention Time - 9.7 hours at design flow.

FINAL SETTLING TANKS

2 - concrete, similar to primary tanks
Mechanism by Dorr-Oliver Long.

CHLORINE CONTACT CHAMBER

1 concrete tank
Dimensions - 30 ft. x 15 ft. x 6 ft. 8"
Volume - 18,700 gallons
Retention time - 15 minutes
400 lb/day Chlorinator by Fischer and Porter.

SLUDGE HOLDING TANKS

1 concrete tank 20 ft. by 20 ft. by 11 ft. deep.

VACUUM FILTER

1 - 10 ft. diameter Komline Sanderson Coil Filter 250 sq. ft.

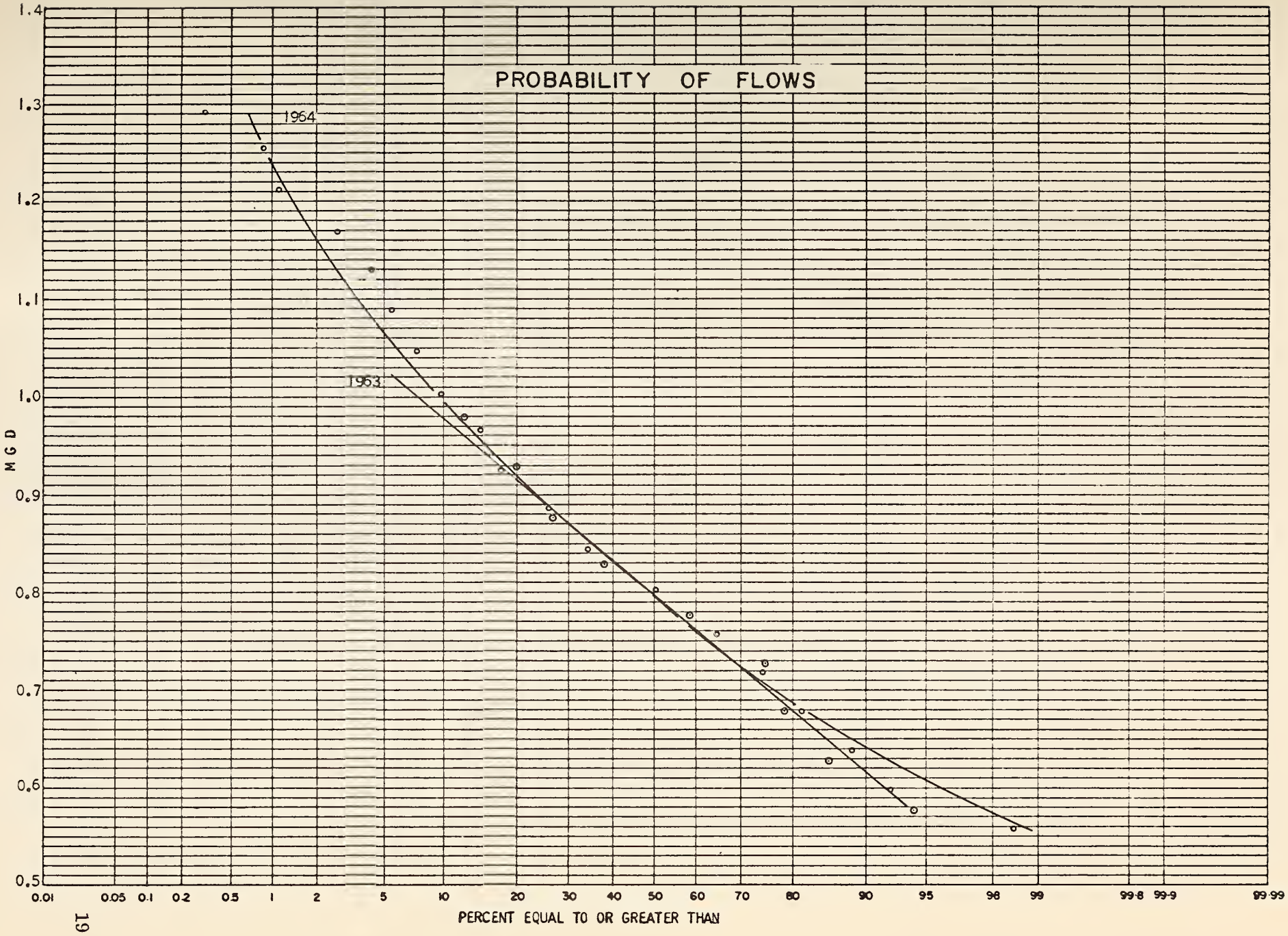
Process Data

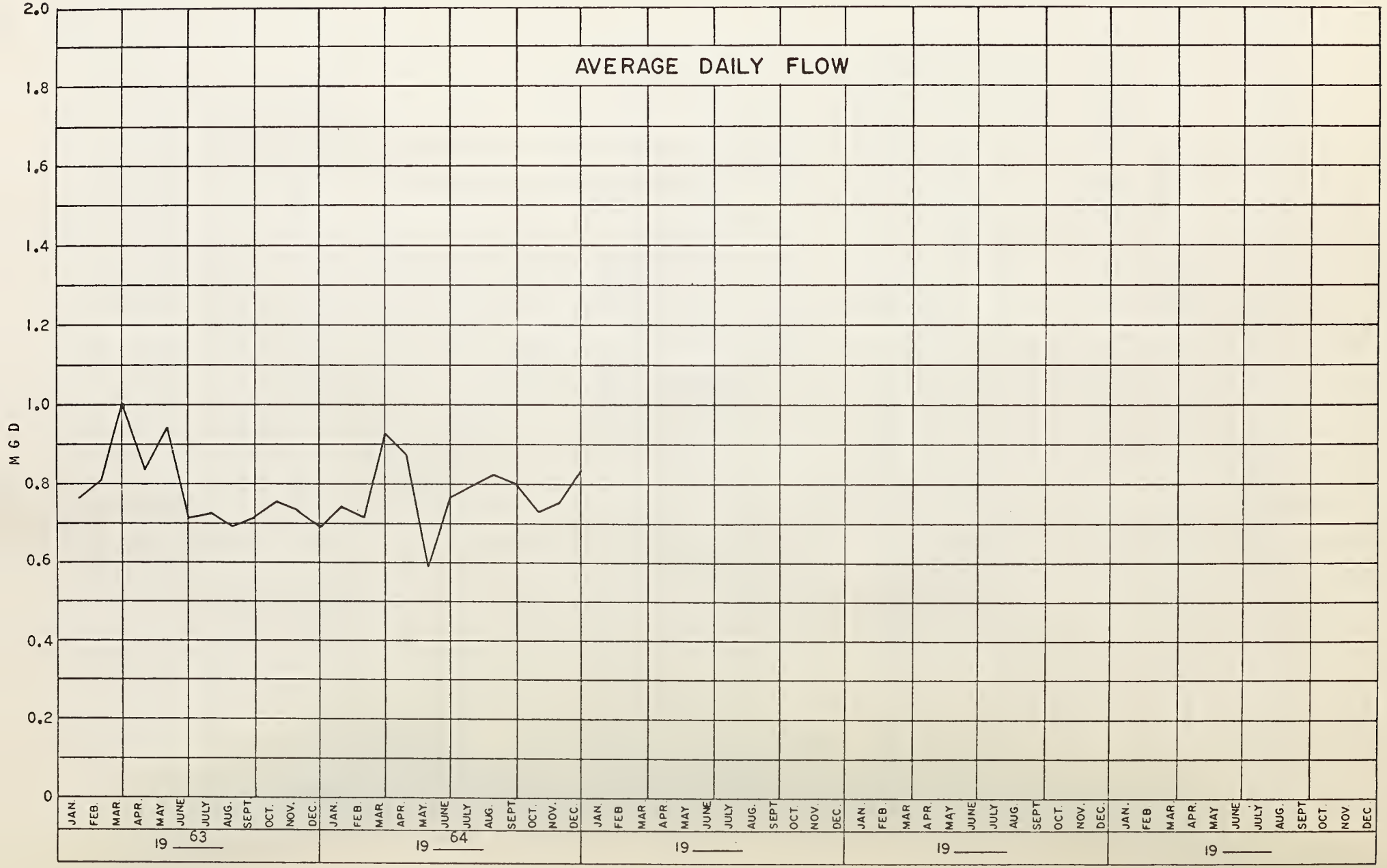
FLOWS

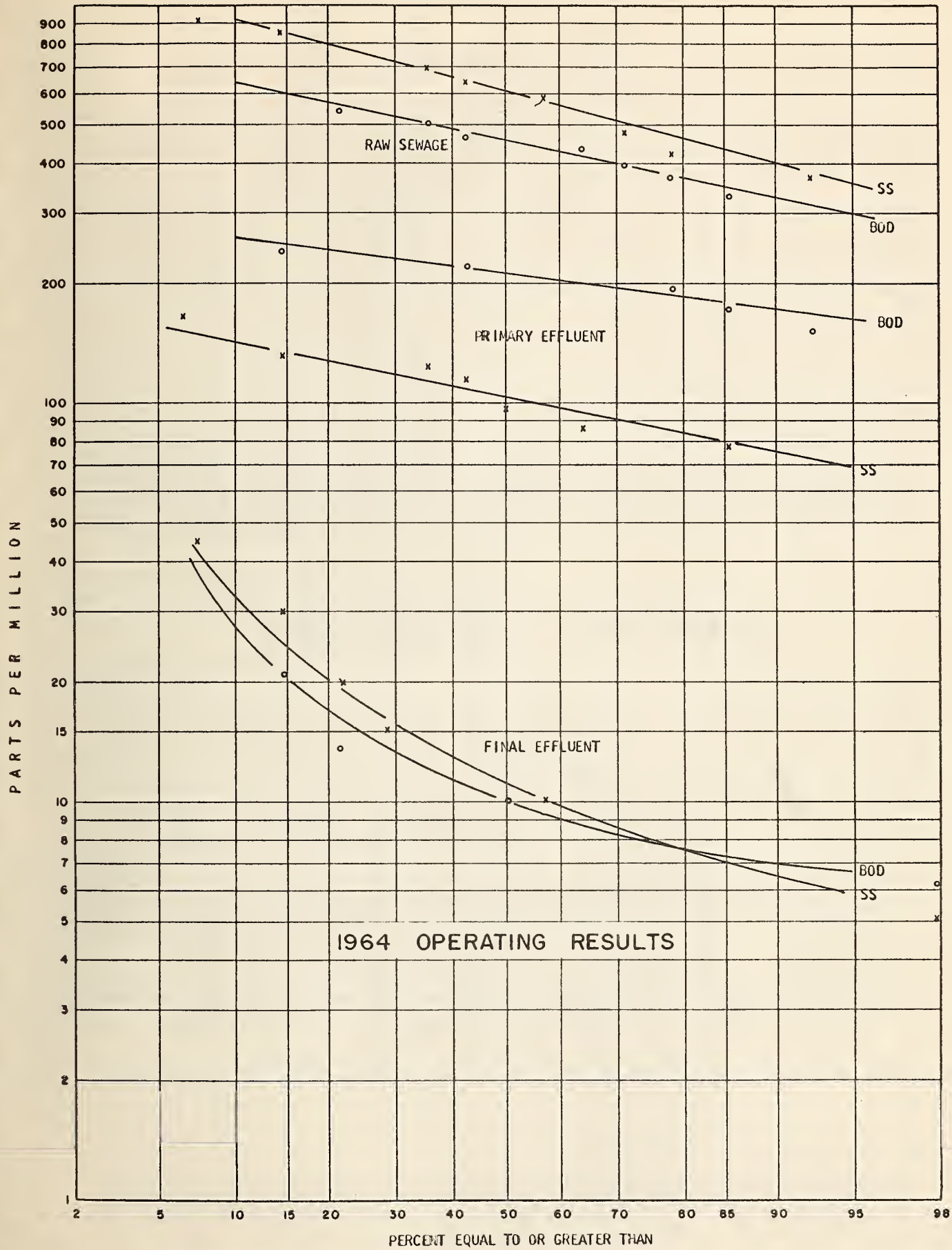
It may be seen from the graph showing average daily flows that the average of 0.78 million gallons per day in 1964 was approximately the same as the average for 1963. These flows are considerably less than the design flow of 1.8 mgd. The probability graph of flows shows that 99% of the time, the flows are considerably less than the design flow and that one half the design flow is exceeded only 22% of the time. Maximum flow rates as high as 5.3 mgd occur during storms.

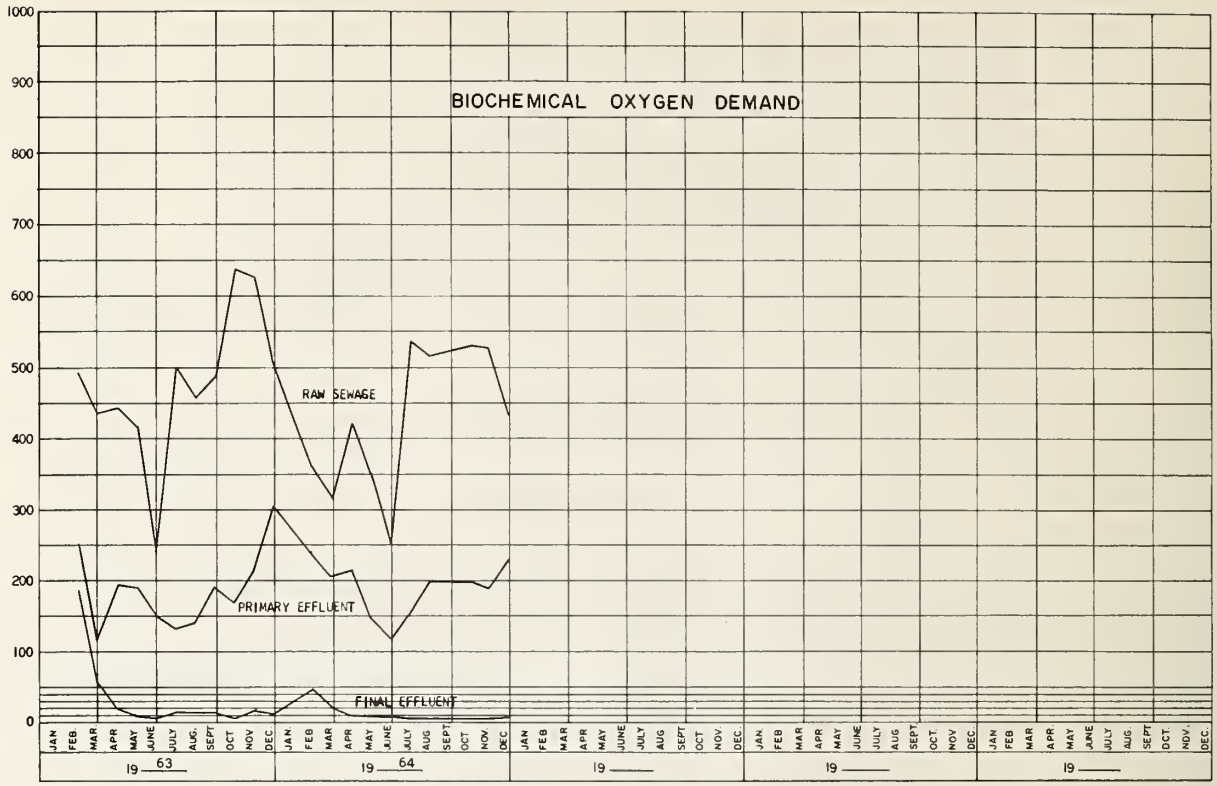
BOD AND SUSPENDED SOLIDS

The graphs on pages 21 and 22 show that the design concentrations in BOD and suspended solids are exceeded about 95% of the time. The reduction of suspended solids through the primary settling tanks is greater than the BOD reduction. This is a normal operating result at most treatment plants. The OWRC objective in BOD and suspended solids concentrations of 15 ppm in the final effluent were exceeded 45% of the time in 1963 and 25 to 30% in 1964. This represents an improvement in the treatment at the plant. The higher results in 1963 were partly due to the start-up period at the plant.

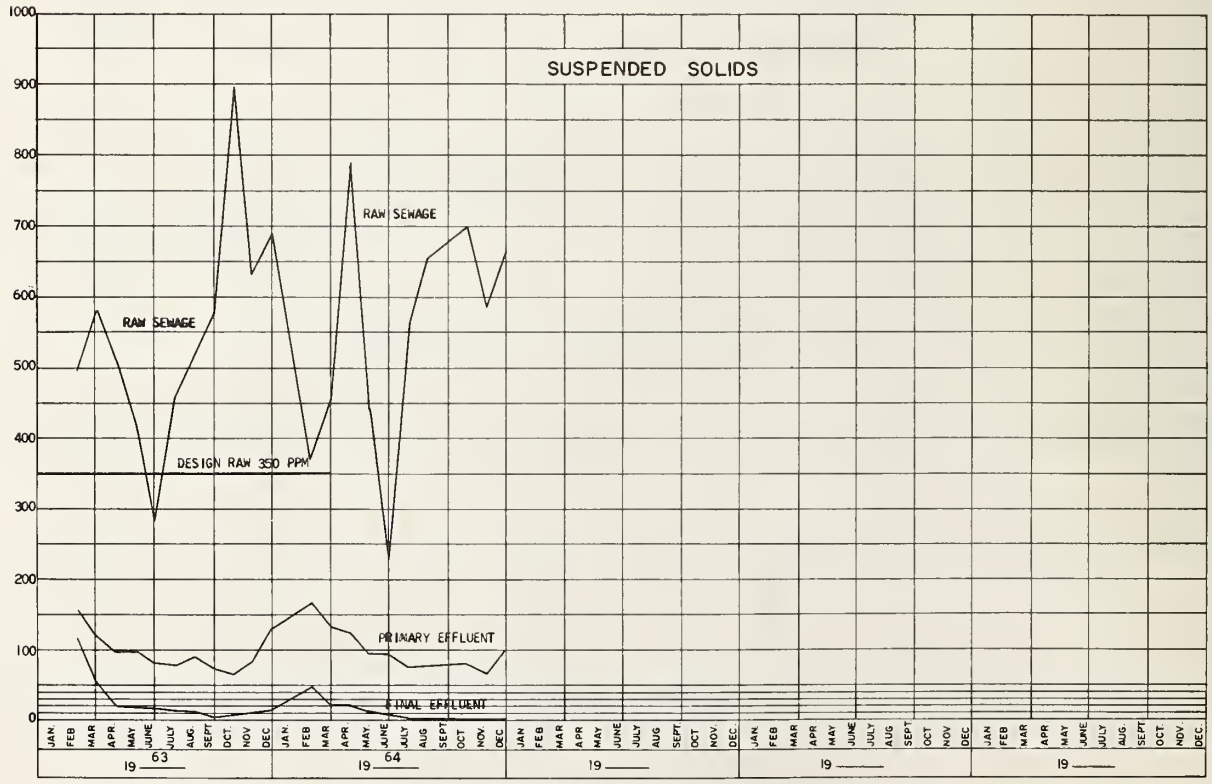

PROBABILITY OF FLOWS
1964
1963
M G D
1.4
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.01
0.05
0.1
0.2
0.5
1
2
5
10
20
30
40
50
60
70
80
90
95
98
99
99.8
99.9
99.99
PERCENT EQUAL TO OR GREATER THAN


AVERAGE DAILY FLOW
M G D
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0
JAN. FEB. MAR. APR. MAY JUNE JULY AUG. SEPT OCT. NOV. DEC.
19 63
19 64
19 ____
19 ____
19 ____


PARTS PER MILLION
900
800
700
600
500
400
300
200
100
90
80
70
60
50
40
30
20
15
10
9
8
7
6
5
4
3
2
1
RAW SEWAGE
SS
BOD
PRIMARY EFFLUENT
BOD
SS
FINAL EFFLUENT
BOD
SS
1964 OPERATING RESULTS
2
5
10
15
20
30
40
50
60
70
80
85
90
95
98
PERCENT EQUAL TO OR GREATER THAN



MONTHLY VARIATIONS



GRIT, B.O.D AND S.S. REMOVAL

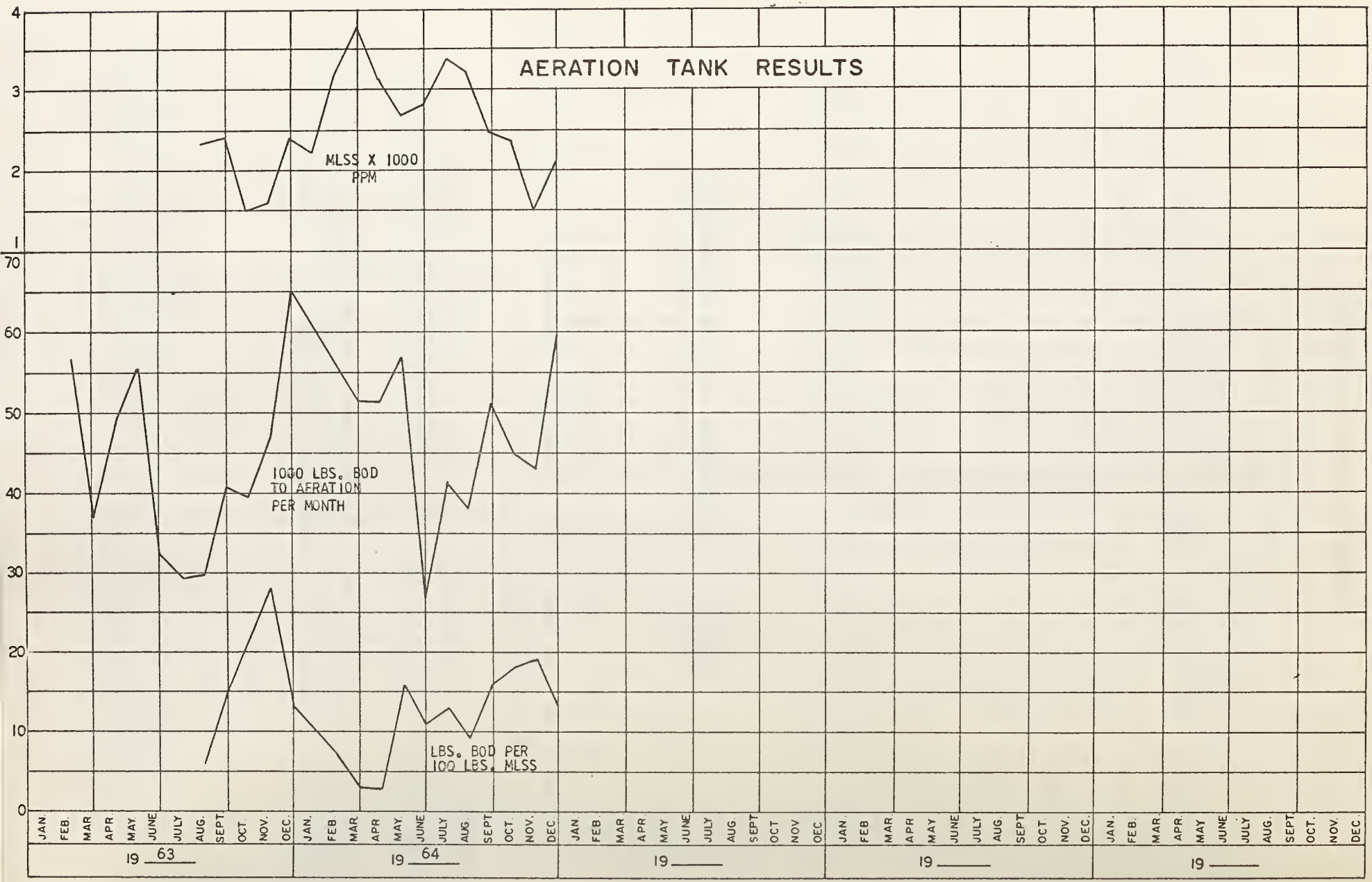
MONTH	B. O. D.				S. S.				GRIT
	INFLUENT P.P.M.	EFFLUENT P.P.M.	% REDUCTION	TONS REMOVED	INFLUENT P.P.M.	EFFLUENT P.P.M.	% REDUCTION	TONS REMOVED	REMOVAL CU. FT.
JAN.	*428	17	96.0	47.0	549	13	97.5	61.4	14
FEB.	360	47	87	32.4	370	47	87	33.5	-
MAR.	320	20	93.5	42.9	458	20	95.5	62.7	8
APR.	425	10	97.5	54.2	792	20	97.5	100.9	10
MAY	352	9.8	97	31	447	11	97.5	39.5	7
JUNE	255	8.4	96.5	28.3	232	5	98	26.0	20
JULY	540	5.0	99.0	65.4	568	2	99.5	69.2	-
AUG.	520	4.2	99.0	65.5	660	7	99.0	83.0	7
SEPT.	*428	*17	*96.0	*49.3	*549	*13	*97.5	*64.3	* 9
OCT.	535	6.3	99.0	59.7	702	8	99.0	78.3	14
NOV.	530	4.4	99.0	59.1	594	3	99.5	66.5	14
DEC.	440	8	98.0	56.1	668	7	99.0	85.9	16
TOTAL	-	-	-	584.3	-	-	-	762.0	119
AVG.	428	17	96.0	48.7	549	13	97.5	63.5	10

* average values substituted. No sample

COMMENTS

The average percent reduction of 96% for BOD and 97.5% for suspended solids is considered to be very effective treatment and is an improvement over the 1963 values of 93% and 94.1% respectively.

The average raw sewage BOD and SS concentrations of 428 and 549 ppm respectively are considered very high and the effective reduction can only be attributed to good operation. These values have not changed much since 1963.

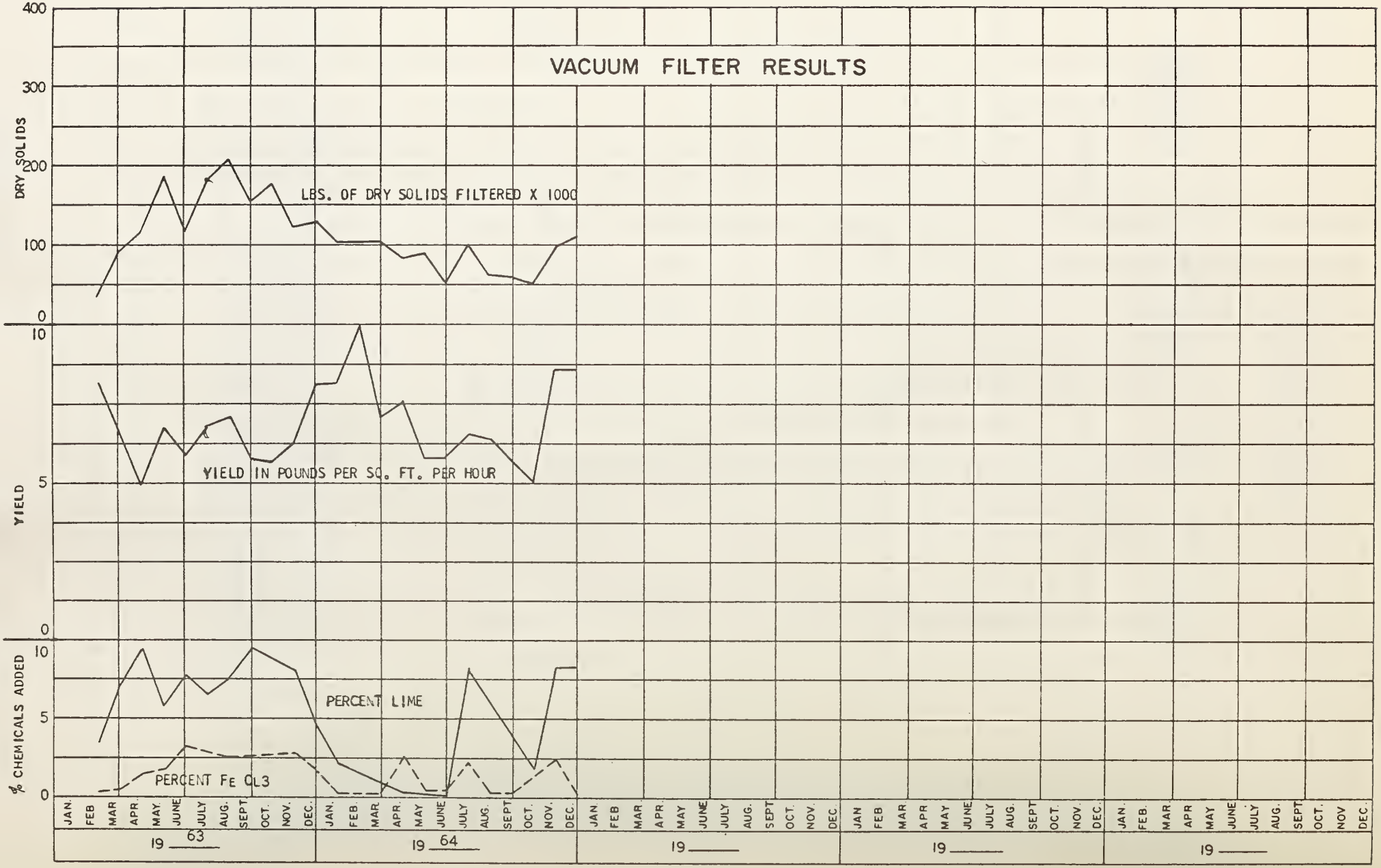

AERATION TANK RESULTS
MLSS X 1000 PPM
1000 LBS. BOD TO AERATION PER MONTH
LBS. BOD PER 100 LBS. MLSS
4
3
2
1
70
60
50
40
30
20
10
0
JAN. FEB. MAR APR MAY JUNE JULY AUG. SEPT OCT. NOV. DEC.
19 63
19 64
19 ____

AERATION SECTION

MONTH	PRIM. EFFL. B.O.D. P.P.M.	M.L.S.S. P.P.M.	LBS. BOD. PER 100 LBS. M. L. S. S.	CUBIC FEET AIR PER LB. B.O.D. REMOVED
JANUARY		2226		
FEBRUARY	235	3203	7	
MARCH	205	3780	3	
APRIL	218	3138	16	
MAY	146	2702	11	
JUNE	180	2805	13	
JULY	155	3372	9	
AUGUST	200	3224	16	
SEPTEMBER		2473		
OCTOBER	200	2384	18	
NOVEMBER	190	1496	19	
DECEMBER	230	2114	13	
TOTAL				
AVERAGE	196	2743	12	

COMMENTS

The average BOD concentration of 196 ppm to the aeration section shows that the primary tank reduces the BOD by about 54%. The secondary section of this plant performed well during the year. During the months of January, February, March and December, the plant was operated as an extended aeration process. The rest of the year was conventional operation with one aeration tank in use. The other aeration section was used as an aerobic digester for the waste activated sludge.


VACUUM FILTER RESULTS
DRY SOLIDS
400
300
200
100
0
LBS. OF DRY SOLIDS FILTERED X 1000
YIELD
10
5
0
YIELD IN POUNDS PER SQ. FT. PER HOUR
% CHEMICALS ADDED
10
5
0
PERCENT LIME
PERCENT Fe Cl3
JAN. FEB MAR APR. MAY JUNE JULY AUG. SEPT OCT. NOV. DEC.
19 63
JAN. FEB MAR APR. MAY JUNE JULY AUG. SEPT OCT. NOV. DEC.
19 64
JAN FEB MAR APR MAY JUNE JULY AUG. SEPT OCT. NOV. DEC.
19 ____
JAN FEB MAR APR MAY JUNE JULY AUG. SEPT OCT. NOV. DEC.
19 ____
JAN. FEB. MAR APR MAY JUNE JULY AUG. SEPT OCT. NOV DEC.
19 ____

VACUUM FILTER OPERATION

MONTH	FILTER HOURS		% SOLIDS DIGEST SLUDGE	LBS. DRY SOLIDS FILTERED	LBS. LIME	% LIME	LBS. $FeCl_3$	% $FeCl_3$	% SOLIDS FILTERED SLUDGE	YIELD PSF/HOUR
	#1	#2								
JAN.	50.3		9.2	105538	2200	2.1	421	0.40	32.2	8.2
FEB.	42.5		8.9	105326					31.0	9.9
MAR.	61.0		7.0	107369			662	0.62	28.4	7.1
APR.	52.5		9.0	98552	5750	0.6	2060	2.09	25.3	7.6
MAY.	48.8		6.8	91364			292	0.32	27.1	7.6
JUNE	44.8		5.6	64797	100	0.1	235	0.36	24.9	5.8
JULY	70.8		6.0	100591	8200	8.2	2357	2.34	22.8	5.8
AUG.	39.5		5.4	63455			416	0.66	26.0	6.5
SEPT.	39.5		5.6	61845			546	0.88	28.0	6.4
OCT.	38.0		5.3	52085	900	1.7	725	1.39	27.0	5.7
NOV.	80.0		5.0	99943	8200	8.2	2394	2.40	22.0	5.0
DEC.	49.5		7.5	106608			293	0.27	30.1	8.7
TOTAL	617.2			1057473	25350		10401			
AVG.	51.4		6.8	88123		2.4		0.98	27.1	7.0

NOTE: FOR VACUUM FILTER COSTS SEE PAGE 13

COMMENTS

Due to experiments carried out by the plant staff, it was found that considerable savings in the operation of the vacuum filter could be achieved.

During April through November, the waste activated sludge was placed in the aerobic digester instead of being mixed with the raw sludge. The raw sludge can be filtered without the extensive use of chemicals and therefore at less cost. Periodically the aerobic digested sludge was filtered, and some was used on the lawns as fertilizer. The above method of operation resulted in an estimated 10% saving in the cost of operation for the plant.

CHLORINATION

MONTH	PLANT FLOW (MG)	MGD	POUNDS CHLORINE	DOSAGE RATE (PPM)
JANUARY	22.899	.736	1436	6.27
FEBRUARY	20.733	.714	1479	7.13
MARCH	28.618	.923	1672	5.84
APRIL	26.154	.870	1548	5.92
MAY	18.098	.582	1706	9.43
JUNE	22.938	.764	1596	6.96
JULY	24.441	.786	1236	5.06
AUGUST	25.413	.819	1172	4.61
SEPTEMBER	23.986	.799	1058	4.41
OCTOBER	22.568	.726	1144	5.07
NOVEMBER	22.497	.750	788	3.50
DECEMBER	25.981	.834	1130	4.35
TOTAL	284.326		15965	
AVERAGE	23.694		1330	5.62

COMMENTS

An average dosage rate of 5.62 ppm of chlorine was required in 1964 to give a residual of 0.5 ppm of free chlorine. This is a reduction of 17% over the dosage rate required in 1963. The reduction can be attributed to improvements in the chlorination equipment and closer control by the plant staff.

CONCLUSIONS

This report includes valuable data on the efficient operation of the Preston Water Pollution Control Plant. This efficient operation is due mainly to the efforts of the plant staff who have worked closely with the Division of Plant Operations of the OWRC.

Improvements in the methods of disposing of the sludge has kept the 1964 total costs the same as they were during 1963, even though the plant operated for only 10 months in 1963.

ONTARIO WATER RESOURCES COMMISSION